8.5 Noise

8.5.1 Introduction

This section presents an assessment of potential noise impacts resulting from construction and operation of the proposed AES Highgrove Project. Section 8.5.2 presents the fundamentals of acoustics. Section 8.5.3 describes the existing noise environment and the results of an ambient noise survey conducted in the vicinity of the project. Section 8.5.4 presents an environmental analysis, which addresses the potential noise effects during construction and operation, while Section 8.5.5 discusses mitigation measures to ensure no adverse impacts result from noise that may be produced during the construction or operational phases of the project. A description of the LORS applicable to the proposed project is presented in Section 8.5.6. The involved agencies and agency contacts are listed in Section 8.5.7. The permits and permitting schedule are discussed in Section 8.5.8 and Section 8.5.9 includes a list of references.

8.5.2 Fundamentals of Acoustics

Acoustics is the study of sound. Noise is defined as unwanted sound. Airborne sound is a rapid fluctuation or oscillation of air pressure above and below atmospheric pressure creating a sound wave. Acoustical terms used in this subsection are summarized in Table 8.5-1.

TABLE 8.5-1
Definitions of Acoustical Terms

Term	Definition
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise or sound at a given location. The ambient level is typically defined by the L_{eq} level.
Background Noise Level	The underlying ever-present lower level noise that remains in the absence of intrusive or intermittent sounds. Distant sources, such as traffic, typically makeup the background. The background level is generally defined by the L_{90} percentile noise level.
Intrusive	Noise that intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, time of occurrence, tonal content, the prevailing ambient noise level as well as the sensitivity of the receiver. The intrusive level is generally defined by the L_{10} percentile noise level.
Decibel (dB)	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter).
A-Weighted Sound Level (dBA)	The sound level in decibels as measured on a sound level meter using the A-weighted filter network. The A-weighted filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels in this report are A-weighted.
Equivalent Noise Level (L_{eq})	The average A-weighted noise level, on an equal energy basis, during the measurement period.

TABLE 8.5-1
Definitions of Acoustical Terms

Term	Definition
Percentile Noise Level (L_n)	The noise level exceeded during n percent of the measurement period, where n is a number between 0 and 100 (e.g., L_{90})
Community Noise Equivalent Level (CNEL)	The energy average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels from 7:00 p.m. to 10:00 p.m. and 10 decibels from 10:00 p.m. to 7:00 a.m.

The most common metric is the overall A-weighted sound level measurement that has been adopted by regulatory bodies worldwide. The A-weighting network measures sound in a similar fashion to how a person perceives or hears sound; thus, achieving very good correlation in terms of how to evaluate acceptable and unacceptable sound levels.

A-weighted sound levels are typically measured or presented as equivalent sound pressure level (L_{eq}), which is defined as the average noise level, on an equal energy basis for a stated period of time, and is commonly used to measure steady state sound or noise that is usually dominant. Statistical methods are used to capture the dynamics of a changing acoustical environment. Statistical measurements are typically denoted by $L_{xx,}$ where xx represents the percentile of time the sound level is exceeded. The L_{90} is a measurement that represents the noise level that is exceeded during 90 percent of the measurement period. Similarly, the L_{10} represents the noise level exceeded for 10 percent of the measurement period.

Another metric used in determining the impact of environmental noise is the differences in response that people have to daytime and nighttime noise levels. During the evening and nighttime, exterior background noises are generally lower than the daytime levels. However, most household noise also decreases at night and exterior noise becomes more noticeable. Furthermore, most people sleep at night and are sensitive to intrusive noises. To account for human sensitivity to evening and nighttime noise levels, the Community Noise Equivalent Level (CNEL) was developed. The CNEL is a noise index that accounts for the greater annoyance of noise during the evening and nighttime hours.

CNEL values are calculated by averaging hourly L_{eq} sound levels for a 24-hour period, and apply weighting factors to evening and nighttime L_{eq} values. The weighting factor, which reflects the increased sensitivity to noise during nighttime hours, is added to each hourly L_{eq} sound level before the 24-hour CNEL is calculated. For the purposes of assessing noise, the 24-hour day is divided into three time periods, with the following weightings:

- Daytime: 7 a.m. to 7 p.m. (12 hours) Weighting factor of 0 dB
- Evening: 7 p.m. to 10 p.m. (3 hours) Weighting factor of 5 dB
- Nighttime: 10 p.m. to 7 a.m. (9 hours) Weighting factor of 10 dB

The three time periods are then averaged (on an energy basis) to compute the overall CNEL value. For a continuous noise source, the CNEL value is easily computed by adding 6.7 dB to the overall 24-hour noise level (L_{eq}). For example, if the expected continuous noise level from the power plant was 60.0 dBA, the resulting CNEL from the plant would be 66.7 dBA.

The effects of noise on people can be listed in three general categories:

- Subjective effects of annoyance, nuisance, dissatisfaction
- Interference with activities such as speech, sleep, learning
- Physiological effects such as startling and hearing loss

In most cases, environmental noise produces effects in the first two categories only. However, workers in industrial plants may experience noise effects in the last category. No completely satisfactory way exists to measure the subjective effects of noise, or to measure the corresponding reactions of annoyance and dissatisfaction. This lack of a common standard is primarily due to the wide variation in individual thresholds of annoyance and habituation to noise. Thus, an important way of determining a person's subjective reaction to a new noise is by comparing it to the existing or "ambient" environment to which that person has adapted. In general, the more the level or the tonal (frequency) variations of a noise exceed the previously existing ambient noise level or tonal quality, the less acceptable the new noise will be, as judged by the exposed individual.

Table 8.5-2 shows the relative A-weighted noise levels of common sounds measured in the environment and in industry for various sound levels.

TABLE 8.5-2
Typical Sound Levels Measured in the Environment and Industry

Noise Source at a Given Distance	A-Weighted Sound Level in Decibels	Example of Representative Noise Environment	Subjective Impression
Shotgun (at shooter's ear)	140	Carrier flight deck	Painfully loud
Civil defense siren (100 ft)	130		
Jet takeoff (200 ft)	120		Threshold of pain
Loud rock music	110	Rock music concert	
Pile driver (50 ft)	100		Very loud
Ambulance siren (100 ft)	90	Boiler room	
Pneumatic drill (50 ft)	80	Noisy restaurant	
Busy traffic; hair dryer	70		Moderately loud
Normal conversation (5 ft)	60	Data processing center	
Light traffic (100 ft); rainfall	50	Private business office	
Bird calls (distant)	40	Average living room library	Quiet
Soft whisper (5 ft); rustling leaves	30	Quiet bedroom	
	20	Recording studio	
Normal breathing	10		Threshold of hearing

Source: Beranek, 1998.

8.5.3 Affected Environment

The proposed power plant site is located at 12700 Taylor Street in the City of Grand Terrace, in southwestern San Bernardino County, California. The proposed power plant site is located within an urban area that is zoned M2 (Industrial) and is the site of a decommissioned 154 MW thermal power plant, formerly owned by Southern California Edison (SCE). The project site is located within 1000 feet of Interstate Highway 215 (I-215), a major 6-lane highway that extends through the Cities of San Bernardino, Grand Terrace and Riverside.

Land uses in the vicinity of the power plant site on the east include agricultural fields, residences, Pico Park, warehouse, a lumber yard, and undeveloped open space lands. To the west, land uses include a motel, a bar, several light industrial businesses, and undeveloped open space lands near the I-215 interchange.

The proposed project site is also within the vicinity of two rail lines: the Burlington Northern Santa Fe Railroad (BNSF) which borders the site on the west, and Union Pacific Railroad (UPRR), directly east of the site. The BNSF Railroad is a major transportation artery for BNSF in the area. Approximately 55 BNSF freight trains and 30 UPRR freight trains can operate on this track over the course of a typical 24-hour day although actual train volumes can vary by day, week, or month (CJUSD, pg 5-51). In addition to the noise generated by the moving trains, locomotive engineers are required to sound a warning signal, which federal regulations require to be at least 96 decibels (96 dBA) 100 feet in front of the train in its direction of travel, to alert motorists and pedestrians to the presence of an approaching train and to avoid accidents at the at-grade crossings, (CJUSD, pg 5-50). Currently there are 95 daily train events, and projections indicate that 220 train events may occur daily by the year 2025 (CJUSD, pg 5-71). Therefore, the presence of the railroad represents a major feature of the existing noise environment in the area.

Sensitive residences in the vicinity of the project include two groups of residences located south and east of the site. Residences east of the project are located approximately 1,850 feet from the center of the proposed plant. Residences southwest of the project, on the south side of Main St., are also located approximately 1,850 feet from the center of the proposed plant.

Another future sensitive receptor includes a proposed high school. The proposed high school, referred to as Colton Joint Unified School District High School #3, would be located east of the project, bordered by Main St. on the south and Taylor St. on the east. The high school is proposed to consist of school buildings for classroom instructional activity as well as sports fields. The school feature that would be located closest to the proposed Highgrove Project is the football stadium, which would be constructed on the east side of Taylor, with the northern end near the current intersection of Taylor and Pico Streets. According to the description of the school facilities contained in the Draft EIR for the proposed school, the classroom building closest to the Highgrove Project would be approximately 1,260 feet southeast of the center of the plant.

A detailed evaluation of the potential noise impacts from construction and operation of the Highgrove Project at the locations of these sensitive receptors is provided below.

8.5.3.1 Ambient Noise Survey

Continuous ambient noise monitoring was conducted at three representative locations to determine the existing noise levels in the vicinity of the project. The monitoring locations selected for evaluation are shown in (Figure 8.5-1) and include the following. Monitoring location R1, located at 17285 Royal Avenue, was selected to represent the group of residences east of the project site; monitoring location R2, in an area currently operated as a lumber yard, was selected to describe ambient noise levels for a general area within the proposed school boundaries; monitoring location R3, located at 28 Highland Avenue, was selected to represent the group of residences southwest of the project site.

Sound level meters deployed at these locations included three Larson Davis 824s. The sound level meters were field calibrated before and after the measurement with a Larson Davis CAL200. All equipment was ANSI Type 1 (precision) and was factory calibrated within the previous 12 months. Winds were generally calm with brief periods up to 10 mph. Daytime temperatures were in the low 90 degrees Fahrenheit (°F) and nighttimes in the mid- to upper-50°F.

The existing noise environment can be characterized by roadway noise, train noise and noise from commercial activities in the vicinity of the site. The noise levels are reflective of the environment's urban character. The hourly results for noise levels L_{eq}, L_{10}, L_{50} and L_{90} are shown in Tables 8.5-3 through 8.5-5.

TABLE 8.5-3
Summary of Hourly Measurements at R1 (dBA)

Date and Time	L_{eq}	L_{10}	L_{50}	L_{90}
5/19/2005 12:00	53	56	52	50
5/19/2005 13:00	50	53	49	42
5/19/2005 14:00	53	55	52	51
5/19/2005 15:00	55	57	53	50
5/19/2005 16:00	57	59	56	53
5/19/2005 17:00	55	57	55	52
5/19/2005 18:00	55	56	54	52
5/19/2005 19:00	52	55	51	45
5/19/2005 20:00	54	55	48	45
5/19/2005 21:00	48	49	44	42
5/19/2005 22:00	51	53	47	43
5/19/2005 23:00	53	54	52	47
5/20/2005 0:00	48	48	42	40
5/20/2005 1:00	51	48	43	40
5/20/2005 2:00	43	44	42	40
5/20/2005 3:00	51	49	43	42

TABLE 8.5-3
Summary of Hourly Measurements at R1 (dBA)

Date and Time	L_{eq}	L_{10}	L_{50}	L_{90}
5/20/2005 4:00	52	48	45	43
5/20/2005 5:00	49	51	47	44
5/20/2005 6:00	51	53	50	48
5/20/2005 7:00	51	52	50	48
5/20/2005 8:00	53	54	51	50
5/20/2005 9:00	54	56	51	50
5/20/2005 10:00	51	53	51	50
5/20/2005 11:00	50	53	46	42
5/20/2005 12:00	57	60	53	50

TABLE 8.5-4
Summary of Hourly Measurements at R2 (dBA)

Date and Time	L_{eq}	L_{10}	L_{50}	L_{90}
5/19/2005 9:00	55	57	51	46
5/19/2005 10:00	60	61	52	46
5/19/2005 11:00	56	57	51	47
5/19/2005 12:00	60	56	51	48
5/19/2005 13:00	60	59	53	50
5/19/2005 14:00	62	63	56	52
5/19/2005 15:00	63	63	56	52
5/19/2005 16:00	59	59	53	50
5/19/2005 17:00	62	56	51	48
5/19/2005 18:00	61	55	50	48
5/19/2005 19:00	65	63	52	49
5/19/2005 20:00	61	58	54	51
5/19/2005 21:00	61	58	54	51
5/19/2005 22:00	60	58	53	51
5/19/2005 23:00	57	54	50	46
5/20/2005 0:00	56	55	49	45
5/20/2005 1:00	52	52	49	45

TABLE 8.5-4
Summary of Hourly Measurements at R2 (dBA)

Date and Time	L_{eq}	L_{10}	L_{50}	L_{90}
5/20/2005 2:00	56	54	48	44
5/20/2005 3:00	57	55	47	43
5/20/2005 4:00	57	54	45	42
5/20/2005 5:00	55	55	47	45
5/20/2005 6:00	56	58	51	48
5/20/2005 7:00	57	59	52	47
5/20/2005 8:00	59	61	51	45
5/20/2005 9:00	58	56	49	44
5/20/2005 10:00	58	57	50	47

TABLE 8.5-5
Summary of Hourly Measurements at R3 (dBA)

Date and Time	L_{eq}	L_{10}	L_{50}	L_{90}
5/19/2005 10:00	56	56	51	47
5/19/2005 11:00	54	56	50	46
5/19/2005 12:00	56	56	49	46
5/19/2005 13:00	53	55	51	47
5/19/2005 14:00	55	56	52	49
5/19/2005 15:00	57	57	53	51
5/19/2005 16:00	54	56	53	51
5/19/2005 17:00	56	56	51	48
5/19/2005 18:00	55	55	50	48
5/19/2005 19:00	59	59	50	48
5/19/2005 20:00	56	54	47	44
5/19/2005 21:00	57	55	47	43
5/19/2005 22:00	59	57	47	43
5/19/2005 23:00	54	51	44	42
5/20/2005 0:00	60	56	45	42
5/20/2005 1:00	52	50	46	41
5/20/2005 2:00	58	54	44	40
5/20/2005 3:00	59	57	46	42

TABLE 8.5-5
Summary of Hourly Measurements at R3 (dBA)

Date and Time	L_{eq}	L_{10}	L_{50}	L_{90}
5/20/2005 4:00	58	56	46	42
5/20/2005 5:00	58	57	49	45
5/20/2005 6:00	57	56	49	46
5/20/2005 7:00	56	58	51	48
5/20/2005 8:00	55	56	51	47
5/20/2005 9:00	56	56	50	46
5/20/2005 10:00	56	57	51	48

8.5.4 Environmental Analysis

This section provides a description of the significance criteria for noise according to the California Environmental Quality Act (CEQA), evaluation criteria established by the CEC for noise evaluations and an assessment of the noise produced by the project during the construction and operational phases of the project.

8.5.4.1 Significance Criteria and Methodology

The California Environmental Quality Act (CEQA) (California Code of regulations, Title 14, Appendix G, Section XI), provides the following guidelines be considered when evaluating whether noise levels produced by the project would cause a significant impact:

- Exposure of people to noise levels in excess of standards established in the local General Plan or noise ordinance
- Exposure of people to excessive ground-borne noise levels or vibration
- Substantial permanent increase in ambient noise levels in the vicinity
- Substantial temporary or periodic increase in ambient noise levels in the project vicinity

CEQA guidelines do not establish any specific numerical thresholds of significance, but rather seek to avoid exposure of persons to “excessive” noise levels or to noise levels that exceed local standards. The evaluation should also distinguish between temporary and periodic increases in ambient noise levels from permanent increases in ambient noise levels. Therefore, in order to establish specific numerical thresholds of significance, an understanding of the noise regulatory framework in the local area as well as a determination of the type and duration of noise elements is warranted.

The California Energy Commission (CEC) Staff has opined that a potential for a significant noise impact exists where the noise of the project exceeds the background noise by 5 dBA or more. To determine whether an increase between 5 and 10 dBA is considered a significant impact, it is important to consider many factors including whether the noise increase occurs in a non-rural setting, whether it affects a large number of people, and whether the noise is continuous, or short-lived and infrequent.

Based on these guidelines, the following methodology was employed for the purpose of evaluating whether or not the Highgrove Project will result in significant noise impacts.

- Noise from the Highgrove Project was modeled and compared to noise levels at the locations representative of the closest sensitive receptors.
- If the increase in noise is less than or equal to 5 dBA, the increase was determined to be less than significant.
- If the increase in noise is greater than 5 dBA, then the duration frequency and proximity of the potential receptor to the noise source will be further evaluated.

Construction noise is typically insignificant if: (1) the construction activity is temporary, (2) use of heavy equipment and noisy activities is limited to daytime hours, and (3) all feasible noise abatement measures are implemented for noise-producing equipment.

In addition to the proposed development of the high school, the City of Grand Terrace also has plans to develop property to the north of the project into a commercial center. Development of the Outdoor Adventures Center will include the widening and extension of Taylor Street which will ultimately connect to Barton Avenue. With these proposed developments, it is anticipated that the project area will experience increases in daytime ambient noise levels even without construction of the Highgrove Project. Therefore, instead of comparing the Highgrove Project's expected noise level to the noise levels obtained from field measurements of existing noise, noise generated by the Project was compared to the ambient noise expected after the high school is constructed. The expected ambient levels of operation of the high school were taken directly from the High School EIR noise analysis. For residential uses, the project was compared to measured nighttime ambient noise levels.

8.5.4.2 Construction Impacts

This subsection addresses the various components of construction noise and vibration for each of the sensitive receptors.

8.5.4.2.1 Worker Exposure to Noise

Construction workers at the project site were considered to be sensitive receptors for noise impact evaluation. Worker exposure levels during construction of the project will vary depending on the phase of the project and the proximity of the workers to the noise-generating activities. Hearing protection will be available for workers and visitors to use as needed throughout the duration of the construction period. A Hearing Protection Plan, which complies with Cal-OSHA requirements, will be incorporated into the Health and Safety Plan.

8.5.4.2.2 Plant Construction Noise

Construction of the project is expected to be typical of other power plants in terms of schedule, equipment used, and other types of activities. The noise level will vary during the construction period, depending upon the construction phase. Construction of power plants can generally be divided into five phases that use different types of construction equipment.

The five phases are: (1) demolition, site preparation, and excavation; (2) concrete pouring; (3) steel erection; (4) mechanical; and (5) clean-up (Miller et al., 1978).

Both the USEPA Office of Noise Abatement and Control and the Empire State Electric Energy Research Company have studied noise from individual pieces of construction equipment as well as from construction sites of power plants and other types of facilities extensively (USEPA, 1971; Barnes et al., 1976). Since specific information on types, quantities, and operating schedules of construction equipment is not available at this point in project development, information from these documents for similarly sized industrial projects will be used. Use of this data, which is between 21 and 26 years old, is conservative since the evolution of construction equipment has been toward quieter designs to protect operators from exposure to high noise levels.

The loudest equipment types generally operating at a site during each phase of construction are presented in Table 8.5-6. The composite average or equivalent site noise level, representing noise from all equipment, is also presented in the table for each phase.

TABLE 8.5-6
Construction Equipment and Composite Site Noise Levels

Construction Phase	Loudest Construction Equipment	Equipment Noise Level (dBA) at 50 feet	Composite Site Noise Level (dBA) at 50 feet
Demolition, Site Clearing, and Excavation	Dump truck Backhoe	91 85	89
Concrete Pouring	Truck Concrete mixer	91 85	78
Steel Erection	Derrick crane Jack hammer	88 88	87
Mechanical	Derrick crane Pneumatic tools	88 86	87
Cleanup	Rock drill Truck	98 91	89

Source: USEPA, 1971; Barnes et al., 1976.

Average or equivalent construction noise levels projected at various distances from the site are presented in Table 8.5-7. These results are conservative since the only attenuating mechanism considered was divergence of the sound waves in open air. Shielding effects of intervening structures are not included in the calculations. The construction noise may be audible at the nearest residences but the noisiest construction activities will be confined to the daytime hours. Table 8.5-8 presents noise levels from common construction equipment at various distances.

TABLE 8.5-7
Average Construction Noise Levels at Various Distances

Construction Phase	Sound Pressure Level (dBA)		
	375 feet	1,500 feet	3,000 feet
Demolition, Site Clearing, and Excavation	71	59	53
Concrete Pouring	60	48	42
Steel Erection	69	57	51
Mechanical	69	57	51
Clean-Up	71	59	53

TABLE 8.5-8
Noise Levels from Common Construction Equipment at Various Distances

Construction Equipment	Typical Sound Pressure Level (dBA)		
	50 feet	375 feet	1,500 feet
Pile drivers (20,000-32,000 ft-lbs./blow)	104	86	74
Dozer (250-700 hp)	88	70	58
Front end loader (6-15 cu. yds.)	88	70	58
Trucks (200-400 hp)	86	68	56
Grader (13 to 16 ft. blade)	85	67	55
Shovels (2-5 cu. yds.)	84	66	54
Portable generators (50-200 kW)	84	66	54
Derrick crane (11-20 tons)	83	65	53
Mobile crane (11-20 tons)	83	65	53
Concrete pumps (30-150 cu. yds.)	81	63	51
Tractor (3/4 to 2 cu. Yds.)	80	62	50
Unquieted paving breaker	80	62	50
Quieted paving breaker	73	55	43

Noise generated during the testing and commissioning phase of the project is not expected to be substantially different from that produced during normal full-load operation. Starts and abrupt stops are more frequent during this period, but on the whole they are usually short-lived.

8.5.4.2.3 Construction Vibration

Construction vibrations can be divided into three classes, based on the wave form and its source:

Wave form: Impact	Example source: impact pile driver or blasting
Wave form: Steady state	Example source: vibratory pile driver
Wave form: Pseudo steady state	Example source: double acting pile hammer

Pile driving is not anticipated to be required at this site. Until a site-specific geotechnical report is prepared, however, it is not certain whether or not pile driving will be needed. If needed, pile driving will be limited to daytime work hours to reduce any noise impacts to the surrounding environment.

8.5.4.3 Operational Impacts

This subsection describes the expected noise impacts from operation of the plant on plant workers, residents and on school activities.

8.5.4.3.1 Worker Exposure to Operational Noise

The OSHA Guidelines, which were designed to protect workers from excessive noise levels, represent the threshold of significance for workers. To ensure worker protection, various components will be specified not to exceed near-field maximum noise levels of 90 dBA at 3 feet (or 85 dBA at 3 feet where available as a vendor standard). Since there are no permanent or semi-permanent workstations located near any piece of noisy plant equipment, no worker's time-weighted average exposure to noise should approach the level allowable under OSHA guidelines. Nevertheless, signs requiring the use of hearing protection devices will be posted in all areas where noise levels commonly exceed 85 dBA, such as inside acoustical enclosures. Outdoor levels throughout the plant will typically range from 90 dBA near certain equipment to roughly 65 dBA in areas more distant from any major noise source. The project will comply with all applicable OSHA and Cal-OSHA hearing conservation regulations; therefore, the impact to workers is considered less than significant.

8.5.4.3.2 Plant Operation Noise Levels

A noise model of the proposed facility has been developed using source input levels derived from manufacturers' data and field surveys of similar equipment. The noise levels to be produced by the plant during operation have been estimated for each of the monitoring locations. The noise levels represent the anticipated steady-state noise level from the plant with essentially all equipment operating.

The LMS100 gas turbine technology is new. Current noise estimates are derived from test stand equipment. It is anticipated that the field measurements from the first standard unit, available later this year, will document lower noise levels. Therefore, the predicted levels presented here are considered conservative and noise levels are anticipated to be decrease as better acoustical data becomes available.

The noise analysis employed standard acoustical engineering methods. The noise model, CADNA/A by DataKustik Gmbed H of Munich, Germany is very sophisticated and enables one to fully model complex industrial plants. The sound propagation factors used in the model have been adopted from ISO 9613-2, *Acoustics – Sound Attenuation During Propagation Outdoors* and VDI 2714, *Outdoor Sound Propagation*. The model divides the proposed facility into a list of individual point and area noise sources representing each piece of equipment producing a significant amount of noise. The sound power levels representing the standard performance of each of these components are assigned based either on field measurements of similar equipment made at other existing plants, data supplied by manufacturers, or information found in the technical literature. Using these standard sound power levels as a basis, the model calculates the sound pressure level that would occur at each receptor from each source after considering losses from distance, air absorption, blockages, etc. The sum of all these individual levels represents the total plant noise level predicted at the modeling point.

The sound power levels, by octave band, used in the model are summarized in Table 8.5-9. As stated previously, predicted noise levels established by the gas turbine vendor for the LMS100 technology are preliminary. These values are considered to be conservative and it is anticipated that vendor field tests to be conducted in the near future will result in a reduction of these levels.

TABLE 8.5-9
Octave Band Sound Power Levels Used to Model Operations, dB (Flat)

	Octave Band Center Frequency, Hz									
Plant Component	**31.5**	**63**	**125**	**250**	**500**	**1k**	**2k**	**4k**	**8k**	**dBA**
Stacks	125	115	109	101	92	85	84	93	77	99
SCR Duct Walls	116	104	103	104	99	90	87	84	65	100
LMS100 Combustion Turbine Generator	119	118	118	109	103	100	99	104	97	110
Fuel Gas Compressors	115	116	112	109	110	111	109	109	108	115
Transformers	108	111	105	105	100	94	91	88	88	102
Cooling Towers	110	104	101	99	96	96	92	88	81	100

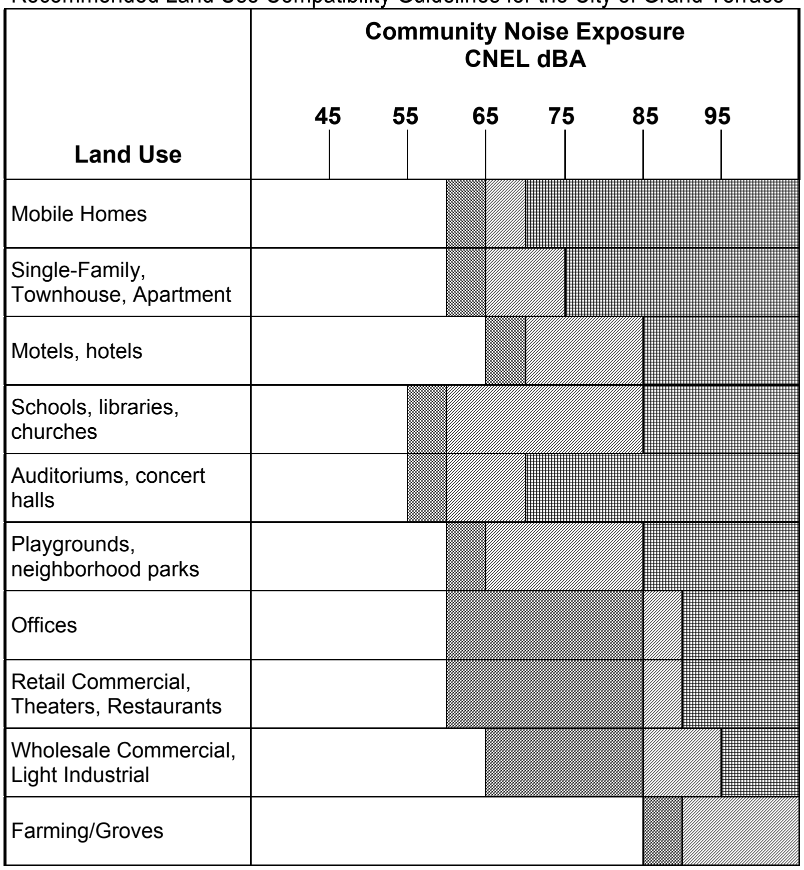
Note: Data reflects best available preliminary noise data from General Electric.

The following sections describe the predicted noise levels at each sensitive receptor, the applicable threshold of significance and the potential for noise impacts.

Proposed High School

To evaluate whether the Highgrove Project's operational noise levels would impact the proposed high school, the project's noise levels were compared to the thresholds established in the School's EIR and the City of Grand Terrace's requirements for schools and playgrounds. The school outdoor activities are associated with the outdoor sports fields and physical education classes; indoor activities include classroom instructional activity. The City of Grand Terrace General Plan Noise Element discuses the effects of noise exposure on the population and sets land use compatibility goals aimed at protecting its residences from undo noise. The City of Grand Terrace establishes interior and exterior noise standards for land use, shown in Table 8.5-10. According to the City's Noise Standards the maximum permissible CNEL at the school buildings is 60 dBA and the maximum permissible CNEL for the play and sports fields is 65 dBA.

TABLE 8.5-10
Recommended Land Use Compatibility Guidelines for the City of Grand Terrace



Source: City of Grand Terrace General Plan.

INTERPRETATION

Clearly Acceptable

The noise exposure is such that the activities associated with the land use may be carried out with essentially no interference from aircraft noise. (Residential areas: both indoor and outdoor noise environment)

Normally Acceptable

The noise exposure is great enough to be of some concern, but common building constructions will make the indoor environment acceptable, even for sleeping quarters. (Residential areas: the outdoor environment will be reasonably pleasant for recreation and play).

Normally Unacceptable

The noise exposure is significantly more severe, so that unusual and costly building constructions are necessary to ensure adequate performance of activities. (Residential areas: barriers must be erected between the site and prominent noise sources to make the outdoor environment tolerable.)

Clearly Unacceptable

The noise exposure at the site is so severe that construction costs to make the indoor environment acceptable for performance of activities would be prohibitive. (Residential areas: the outdoor environment would be intolerable for normal residential use.)

Unlike the Leq metric, the CNEL noise metric is based on 24 hours of measurement. CNEL also differs from Leq in that it applies a time-weighted factor designed to emphasize noise events that occur during the evening and nighttime hours (when quiet time and sleep disturbance are a typical concern). Noise occurring during the daytime period (7 a.m. to 7 p.m.) receives no penalty. Noise produced during the evening time (7 p.m. to 10 p.m.) is penalized by 5 dBA, while nighttime (10 p.m. to 7 a.m.) noise is penalized by 10 dBA. Therefore, a CNEL of 65 dBA is complied with when the daytime noise level is less than or equal to 65 dBA, the evening noise level is less than or equal to 60 dBA and the nighttime level is less than or equal to 55 dBA. The L_{dn} noise metric is similar to the CNEL metric except the period from 7 p.m. to 10 p.m. receives no penalty. Both the CNEL and Ldn metrics yield approximately the same 24- hour value (within 1 dBA) with the CNEL being the more restrictive, i.e., the higher of the two.

Because educational activities would not occur during the evening or nighttime at the proposed school, the Colton Unified School District adopted in its EIR an Leq-12 standard of

65 dBA for determining whether the school site and students would be exposed to significant noise levels. An Leq-12 is an Leq that is averaged over 12 daytime hours (from 7 a.m. to 7 p.m.). The EIR states that this noise metric has been adopted by numerous cities for those land uses (such as schools), which are not in use or considered noise-sensitive during the evening or nighttime hours because they are not occupied (CJUSD, pg 5-48).

The noise generated by the Project, as predicted by the modeling, is 56 dBA at the corner of the closest main building to the project (approximately 1,260 feet measured in a southeast direction from the center of the project.). This noise level is likely conservative in that it does not take into account any potential shielding from any offsite structures (such as the football stadium). This level is below the City General Plan daytime CNEL of 60 dBA for schools and below the 65 dBA Leq-12 significance threshold adopted by the School District. The maximum noise predicted at the northwest corner of the football stadium (the corner nearest the proposed project) is 63 dBA. This noise level is also below the City General Plan daytime 65 CNEL for outdoor playgrounds and below the 65 dBA Leq-12 standard adopted by the School District. Therefore, the Highgrove Project will not create noise levels during operation that would violate any standard adopted by either the City of Grand Terrace or the Colton Joint Unified School District for either the school buildings or outdoor sports fields.

In addition, the Highgrove Project will not expose students and school employees to noise levels that significantly exceed the noise predicted by outdoor school activities themselves. According to the high school EIR, sport field activities are estimated to result in 64 dBA Leq at a distance of 50 feet and stadium noise is anticipated to vary between 58 and 65 dBA Leq at a distance of 500 feet. This is equivalent to between 78 and 85 dBA Leq at a distance of 50 feet using the same 6 dBA per doubling of distance used in the high school EIR. As indicated above, at the football stadium the maximum operational noise anticipated from the Highgrove Project is 63 dBA, resulting in an increase of not more than 3 dBA. Therefore, the Highgrove Project is not anticipated to result in significant impacts at the stadium or sports fields.

Further, according to mitigation measure 5.5-1 of the School EIR, the School District will incorporate acoustical features in the design of classroom buildings to ensure that interior noise from passing trains will not disturb instructional learning inside the classroom. The design features will reduce an 85 dBA train horn to interior levels below 45 dBA. Noise levels from the Highgrove project are predicted to be 56 dBA at the exterior of the nearest school building. Therefore, with the noise attenuation features to be incorporated into classroom design, operational noise from the Highgrove Project will also be less than 45 dBA inside the classrooms. Therefore, the Highgrove Project will not impact the interior noise thresholds established in the high school EIR for instructional learning.

Residences

The City of Grand Terrace General Plan Noise Element establishes the maximum acceptable CNEL for single-family residences as 65 dBA. Applying the maximum nighttime penalty of 10 dBA would result in an allowable noise level of 55 dBA Leq. The noise level predicted by operation of the Highgrove Project would be 51 dBA at monitoring location R1 (a residential receptor to the east) and 52 dBA at monitoring location R3 (a residential receptor south of the project). Both predicted noise levels are below the acceptable noise level required by the

City General Plan. Using this methodology, the Highgrove Project would not have significant noise impacts at the closest residential receptors.

The Highgrove Project is designed to be a peaking facility, which by definition means, that it is likely to operate only during periods when electricity demand is highest. To assess potential impacts of noise exposure to residents at the locations of the nearest residential receptors, an assessment of plant operational noise levels produced during times when the residents are most likely to be occupying their homes was conducted. Operation between the hours of 10 p.m. and 6 a.m. is expected to be extremely unlikely and would most likely occur only during emergency conditions.

The noise monitoring data reflect the diurnal nature of the urban noise environment resulting from rail and roadway traffic patterns. Because of the urban character and the associated traffic, the L50 metric is the appropriate standard to characterize the ambient conditions that currently exist at the residences. The average L50 during the hours of 6 a.m. to 10 p.m. (which incorporates the period of time that the plant would most likely operate) at R1 is 51 dBA and at R3 is 50 dBA. The predicted noise level from operation of the Highgrove Project at R1 is 51 dBA and at R3 is 52 dBA, which results in no change in ambient noise levels at R1 and an insignificant increase of 2 dBA at R3.

It is extremely unlikely that a peaking facility such as the Highgrove Project would operate between the hours of 10 p.m. and 6 a.m. If the all three units were dispatched during this time, it is expected to only be due to emergency conditions experienced within the regional electrical system. The average L50 during the nighttime hours of 10 p.m. to 6 a.m. at R1 is 45 dBA and at R3 is 46 dBA. As discussed above, in the extremely unlikely event that the project was dispatched at full load (i.e., all 3 units operating) during this time period, noise levels attributable to the project are predicted to be 51 dBA at R1 and 52 dBA at R3, or 6 dBA above existing ambient levels at both locations. Therefore, these impacts are considered to be less than significant. Further, as stated previously, operation is only expected to occur rarely, if at all, during this period of time.

8.5.4.3.3 Tonal Noise

At the monitoring locations modeled here, no significant tones are anticipated. That is not to say that audible tones are impossible—certain sources within the plant such as the combustion turbine inlets, transformers, pump motors, cooling tower fan gearboxes, etc. have been known to sometimes produce significant tones. It is the Applicant's intention to anticipate the potential for audible tones in the design and specification of the plant's equipment and take necessary steps to prevent sources from emitting tones that might be disturbing at the nearest receptors.

8.5.4.3.4 Ground and Airborne Vibration

The proposed project is primarily driven by gas turbines exhausting into a selective catalytic reduction (SCR) duct and a stack silencer. These very large ducts reduce low frequency noise, which is mainly the source of airborne induced vibration of structures.

The equipment that would be used in the proposed project is well balanced and is designed to produce very low vibration levels throughout the life of the project. An imbalance could contribute to ground vibration levels in the vicinity of the equipment. However, vibration-monitoring systems are installed in the equipment to ensure that the equipment remains balanced. Should an imbalance occur, the event would be detected and the equipment would automatically shutdown to prevent damage.

8.5.5 Mitigation Measures

To minimize noise from operation of the Highgrove Project, the following measures have been incorporated into the plant design:

- A berm and wall around the eastern and part of the northern portion of the site;
- A barrier around the fuel gas compressors
- Stack silencing
- Combustion turbine enclosure

As discussed above, the sound level data for the gas turbine is preliminary because the LMS 100 CTG is new technology without the benefit of a long operating history and noise measurement data. Prior to construction of the Highgrove Project, it is anticipated that additional noise monitoring data will be available from the gas turbine vendor and is expected to demonstrate that the noise levels used in the above analysis are conservative.

The following additional mitigation measures are proposed for the project to ensure no adverse noise impacts occur as a result of operation or construction.

8.5.5.1 Noise Mitigation Measure #1

The project owner shall establish a telephone number for use by the public to report any significant undesirable noise conditions associated with the construction and operation of the project. If the telephone is not staffed 24 hours per day, the project-owner shall include an automatic answering feature, with date and time stamp recording, to answer calls when the phone is unattended. This telephone number shall be posted at the project site during construction in a manner visible to passersby. This telephone number shall be maintained until the project has been operational for at least one year.

8.5.5.2 Noise Mitigation Measure #2

Throughout the construction and operation of the project, the project owner shall document, investigate, evaluate, and attempt to resolve all legitimate project-related noise complaints.

The project owner, or authorized agent, shall:

- Use the Noise Complaint Resolution Form typically suggested by CEC or functionally equivalent procedure to document and respond to each noise complaint

- Attempt to contact the person(s) making the noise complaint within 24 hours

- Conduct an investigation to attempt to determine the source of noise related to the complaint

- If the noise complaint is legitimate, take all feasible measures to reduce the noise at its source

8.5.5.3 Noise Mitigation Measure #3

Noisy construction work at the plant site (that causes offsite annoyance as evidenced by the filing of a legitimate noise complaint) shall be restricted to the 7:00 a.m. to 10:00 p.m. time period. Haul trucks shall be operated in accordance with posted speed limits. Truck engine exhaust brake use shall be limited to emergencies.

8.5.6 Laws, Ordinances, Regulations, and Standards

The LORS that apply to noise produced during construction and operation of the project are summarized in Table 8.5-11.

TABLE 8.5-11
Applicable Laws, Ordinances, Regulations, and Standards

LORS	Purpose	Applicability (AFC Section Explaining Conformance)
Federal Offsite:		
USEPA	Guidelines for state and local governments.	Subsection 8.5.6.1.1.
Federal Onsite:		
OSHA	Exposure of workers over 8-hour shift limited to 90 dBA.	Subsections 8.5.6.1.2, 8.5.4.2.1, and 8.5.4.3.1. Also see Subsection 8.7, Worker Safety
State Onsite:		
Cal/OSHA 8 CCR Article 105 Sections 095 et seq.	Exposure of workers over 8-hour shift limited to 90 dBA.	Subsections 8.6.3.2.1, 8.5.4.2.1, and 8.5.4.3.1. Also see Subsection 8.7, Worker Safety
State Offsite:		
Calif. Vehicle Code Sections 23130 and 23130.5	Regulates vehicle noise limits on California highways.	Delivery trucks and other vehicles will meet Code requirements.
Local		
California Government Code Section 65302	Requires local government to prepare plans that contain noise provisions.	City of Grand Terrace, Subsection 8.5.6.3.
City of Grand Terrace - General Plan	The General Plan provides quantitative compatibility goals and policy	Subsections 8.5.6.3.1
City of Grand Terrace - Noise Ordinance	Restricts hours of construction equipment operation between 10 p.m. and 7 a.m. when such activities result in loud or excessive noise at a residence.	Subsections 8.5.6.3.1
Riverside County Code-Chapter 15.04	Limits hours of construction within ¼ mile of a residence to between 6 a.m. and 6 p.m.	Subsections 8.5.6.3.2
City of Riverside	Establishes limits for the hours of construction	Subsections 8.5.6.3.3

8.5.6.1 Federal

8.5.6.1.1 USEPA

Guidelines are available from the USEPA (1974) to assist state and local government entities in development of state and local LORS for noise. Because there are local LORS that apply to this project, the USEPA guidelines are not applicable.

8.5.6.1.2 OSHA

Onsite noise levels are regulated, in a sense, through the Occupational Safety and Health Act of 1970 (OSHA). The noise exposure level of workers is regulated at 90 dBA, over an 8-hour work shift to protect hearing (29 Code of Federal Regulations [CFR] 1910.95). Onsite noise levels will generally be in the 70- to 85-dBA range. Areas above 85 dBA will be posted as high noise level areas and hearing protection will be required. The power plant will implement a hearing conservation program for applicable employees and maintain exposure levels below 90 dBA.

8.5.6.2 State of California

8.5.6.2.1 Cal-OSHA

The California Department of Industrial Relations, Division of Occupational Safety and Health enforces California Occupational Safety and Health Administration (Cal-OSHA) regulations, which are the same as the federal OSHA regulations described previously. The regulations are contained in Title 8 of the California Code of Regulations (CCR), General Industrial Safety Orders, Article 105, Control of Noise Exposure, Sections 5095, et seq.

8.5.6.2.2 California Vehicle Code

Noise limits for highway vehicles are regulated under the California Vehicle Code, Sections 23130 and 23130.5. The limits are enforceable on the highways by the California Highway Patrol and the County Sheriff’s Office.

8.5.6.3 Local

The California State Planning Law (California Government Code Section 65302) requires that all cities, counties, and entities (such as multi-city port authorities) prepare and adopt a General Plan to guide community change. The City of Grand Terrace would have jurisdiction over enforcing its noise standards over activities that occur at the site including operation. The City of Grand Terrace, the County of Riverside and the City of Riverside would also have jurisdiction over noise related to construction of the portions of the proposed natural gas pipeline that run within each of its respective boundaries.

8.5.6.3.1 City of Grand Terrace

Construction

Chapter 8.108, Noise, of the Grand Terrace City Code restricts the hours of construction as follows: “The operation or use between the hours of ten p.m. and seven a.m. of any pile driver, steam shovel, pneumatic hammers, derrick, steam or electric hoist, power driven saw, fork lifts, milling equipment, other tools or apparatus the use of which is attended by loud and excessive noise, or the movement of tractors, tractor trucks, or large trucks on property adjacent to residences is prohibited.” The Highgrove Project will comply with this requirement by restricting such noisy construction activity at the project site to the hours of 7 a.m. to 10 p.m.

Operation

The City of Grand Terrace's General Plan Noise Element establishes acceptable noise levels as shown in Table 8.5-10. For single-family, townhouse and apartments the maximum normally acceptable level is 65 dBA CNEL. For school buildings, the maximum normally acceptable level is 60 dBA CNEL. For playgrounds and outdoor play fields the maximum normally acceptable level is 65 dBA CNEL.

School

The project will comply with the 60 dBA CNEL limit established for the school because predicted noise levels at monitoring location 2, near a main building closest to the project, will be 56 dBA. During the times the school is occupied (7 a.m. to 7 p.m.), this level is equivalent to a 56 CNEL.

School Outdoor Playfields

The project will comply with the 65 dBA CNEL limit for the school outdoor playfields because its predicted noise levels at the football stadium and nearby playfields will be less than 65 dBA. For times the football stadium, which is located closest to the project, is occupied (7 a.m. to 7p.m.) the project noise levels would be less than 65 CNEL. For times the football stadium is occupied after 7 p.m. (i.e., during football games) the noise from the football stadium is predicted to be greater than the noise generated from the Highgrove Project, in the unanticipated event the plant is operated during evening hours

Residences

The project will comply with the 65 CNEL for the residences because during the quietest hours of the night (10 p.m. to 7 a.m.) the equivalent noise standard would be 55 dBA applying the highest nighttime penalty of 10 dBA. The project noise is predicted to be below 55 dBA at both R1 and R2.

8.5.6.3.2 Riverside County

Since Riverside County does not have jurisdiction over the power plant site, Riverside County LORS relating to stationary sources are not addressed. However, since a portion of the natural gas pipeline will be constructed within Riverside County, a discussion of those noise restrictions applicable to construction of that portion of the pipeline is warranted.

Chapter 15.04, Buildings and Construction: General Provisions, Administration and Enforcement, of the Riverside County Code restricts the hours of construction as follows: "Whenever a construction site is within one-quarter of a mile of an occupied residence or residences, no construction activities shall be undertaken between the hours of 6 p.m. and 6 a.m. during the months of June through September and between the hours of 6 p.m. and 6 a.m. during the months of October through May. Exceptions to these standards shall be allowed only with the written consent of the building official." The Highgrove Project will comply with the above restriction by limiting construction of the gas pipeline in those locations where the pipeline is within one-quarter mile of a residence to the hours between 6 a.m. and 6 p.m.

8.5.6.3.3 The City of Riverside

Since the City of Riverside does not have jurisdiction over the power plant site, The City of Riverside LORS relating to stationary sources will not be discussed. However, since a portion of the natural gas pipeline will be constructed within the City of Riverside, a discussion of those noise restrictions applicable to construction of that portion of the pipeline is warranted.

Construction noise is prohibited between the hours of 7:00 p.m. and 7:00 a.m. on weekdays and between 5 p.m. and 8 a.m. on Saturdays, or at any time on Sunday or federal holidays such that the sound therefrom creates a noise disturbance across a residential or commercial property line or at any time exceeds the maximum permitted noise level for the underlying land use category, except for emergency work or by variance. The Highgrove Project will comply with the above restriction by limiting construction of the gas pipeline in those locations of the City of Riverside to the hours of 7 a.m. and 7 p.m. on weekdays and to 8 a.m. to 5 p.m. on Saturdays.

8.5.7 Involved Agencies and Agency Contacts

Agency contacts relative to noise issues are presented in Table 8.5-12.

TABLE 8.5-12
Involved Agencies and Agency Contacts

Agency	Contact/Title	Telephone
Community Development City of Grand Terrace 22795 Barton Road Grand Terrace, CA 92313-5295	Gary Koontz/Community Development Director	(909) 430-2225

8.5.8 Permits Required and Permit Schedule

No permits are required for noise; therefore, there is no permit schedule.

8.5.9 References

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International Organization for Standardization. 1996. *Acoustics – Attenuation of Sound During Propagation Outdoors*, *Part 2: General Method of Calculation.* ISO 9613-2, Geneva, Switzerland.

Miller, Laymon N., et al. 1984. *Electric Power Plant Environmental Noise Guide*, 2nd Edition, Edison Electric Institute, New York.

Miller, L. N., E. W. Wood, R. M. Hoover, A. R. Thompson, and S. L. Thompson, and S. L. Paterson. 1978. *Electric Power Plant Environmental Noise Guide*, Vol. 1. Bolt, Beranek & Newman, Inc. Cambridge, MA. Prepared for the Edison Electric Institute, New York, NY.

U.S. Environmental Protection Agency (USEPA). 1971. *Noise from Construction Equipment and Operations, US Building Equipment, and Home Appliances*. Prepared by Bolt, Beranek & Newman, Inc. for USEPA Office of Noise Abatement and Control, Washington, DC.

Colton Joint Unified School District (CJUSD). 2005. Environmental Impact Report, Grand Terrace Educational Facility, September.

FIGURE 8.5-1
NOISE MONITORING LOCATIONS
AES HIGHGROVE
GRAND TERRACE, CALIFORNIA

CH2MHILL

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